

# OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **NUTTS POND** the program coordinators recommend the following actions.

We are pleased to welcome the Manchester Urban Ponds Restoration Project to the New Hampshire Volunteer Lake Assessment Program. Manchester's volunteers collected a lot of samples this summer and we applaud them for their efforts. Although it takes a few years to establish lake quality trends, we hope that this project will encourage the citizens of the city to continue their active participation in sampling and help to reverse the degraded conditions of the ponds. We encourage the Project Coordinator to establish a wet weather sampling program in the future. Samples collected during rain events allow us to determine non-point sources of pollution to the lake. Since the project's goals include restoring the quality of the urban ponds and reducing pollutant loads data collected from wet weather sampling allows biologists to better evaluate phosphorus loading to the lake.

## **FIGURE INTERPRETATION**

- Figure 1: These graphs illustrate concentrations of chlorophyll-a, also a measure of algal abundance, in the water column. Algae are microscopic plants that are a natural part of lake ecosystems. Algae contain chlorophyll-a, a pigment necessary for photosynthesis. A measure of chlorophyll-a can indicate the abundance of algae in a lake. The current year data (the top graph) show a *high* in-lake chlorophyll-a concentration. In early June the chlorophyll-a concentration was lower than the state mean. The months of July and August had excessive concentrations while September and October were moderately high. The dominant species of algae in these months were dinoflagellates. There is a large deviation between all of the samples (see bottom graph). While algae are present in all lakes, an excess amount of any type is not welcomed. Concentrations can increase when there are internal and external sources of phosphorus, which is the nutrient algae depend upon for growth. It's important to continue the education process and keep residents aware of the sources of phosphorus and how it influences lake quality.
- Figure 2: Water clarity is measured by using a Secchi disk. Clarity, or transparency, can be influenced by such things as algae,

sediments from erosion, and natural colors of the water. The graphs on this page show historical and current year data. The upper graph shows in-lake transparency was *variable* throughout the summer, and was higher than the state mean in both June and August, but below in July, September, and October. The lower graph shows the average was slightly less than the New Hampshire mean. The increased chlorophyll-a values in July and August did not seem to affect the clarity. The 2000 sampling season was considered to be wet and, therefore, average transparency readings are expected to be slightly lower than during dry years. Higher amounts of rainfall usually cause more eroding of sediments into the lake and streams, thus decreasing clarity.

- Figure 3: These figures show the amounts of phosphorus in the epilimnion (the upper layer in the lake) and the hypolimnion (the lower layer); the inset graphs show current year data. Phosphorus is the limiting nutrient for plants and algae in New Hampshire waters. Too much phosphorus in a lake can lead to increases in plant growth over time. These graphs show in-lake epilimnetic phosphorus levels are slightly higher than the state median, but concentrations are excessively high in the hypolimnion. High concentrations of hypolimnetic phosphorus reflect an internal supply of phosphorus to the lake, which can initiate spring algal blooms. We look forward to future testing results and hope that these levels will eventually be drastically decreased. One of the most important approaches to reducing phosphorus levels is educating the public. Humans introduce phosphorus to lakes by several means: fertilizing lawns, septic system failures, and detergents containing phosphates are just a few. Keeping the public aware of ways to reduce the input of phosphorus to lakes means less productivity in the lake. Contact the VLAP coordinator for tips on educating your lake residents or for ideas on testing your watershed for phosphorus inputs.

#### **OTHER COMMENTS**

- The conductivity levels in the hypolimnion were high for an in-lake sample (Table 6). The hypolimnetic sample was usually colored orange from iron precipitate with a very potent smell of Hydrogen Sulfide. This might be attributed to the high metals content that was measured. Due to the nature of the watershed, these levels are probably inevitable. Again, more wet weather sampling will be valuable in finding the sources of pollution to the pond. Once the sources are found techniques can be employed to limit the supply of pollutants to the lake.
- Dissolved oxygen was low in the lower layer throughout the summer (Table 9). The process of decomposition in the sediments depletes dissolved oxygen on the bottom of the lake. As bacteria break down organic matter, they deplete oxygen in the water. When oxygen gets below 1 mg/L, phosphorus normally bound up in the mud may be

released into the water column. This explains the higher phosphorus in the hypolimnion (lower water layer) versus the epilimnion (upper layer). Since an internal source of phosphorus to the lake is present, limiting or eliminating external phosphorus sources in the lake's watershed is even more important for lake protection.

- Please observe the comment in the Notes section below about the questionable conductivity results in September at the Inlet at Home Depot. The value was recorded as 24.63 µg/L, but the results are questionable based on the turbidity and total phosphorus values of the same sample. Hopefully, this inlet will be tested again in the spring so we can check the validity of this year's results.

#### **NOTES**

- Biologist's Note (4/20/00): Boat ramp area repaired with gravel, however gravel susceptible to erosion. Saw great blue heron, mallards. Small pickerel at Tannery Brook (Inlet).
- Monitor's Note (7/24/00): Strange dissolved oxygen readings at 3 meters (supersaturated?). Perhaps algae layer there (brown colored material in 4 meter haul).
- Biologist's Note (7/24/00): Internal loading.
- Monitor's Note (8/30/00): Low water level.
- Biologist's Note (9/15/00): Conductivity of Inlet at Home Depot questionable.
- Monitor's Note (10/27/00): Ducks; green film at water surface.
- Biologist's Note (10/27/00): Green film identified as a blue-green bloom.

#### **USEFUL RESOURCES**

*Anthropogenic Phosphorus and New Hampshire Waterbodies*, NHDES-WSPCD-95-6, NHDES Booklet, (603) 271-3503

*The Lake and Reservoir Restoration Guidance Manual, First Edition*. North American Lake Management Society, 1988. (608) 233-2836 or [www.nalms.org](http://www.nalms.org)

*Road Salt and Water Quality*, WD-WSQB-7, NHDES Fact Sheet, (603) 271-3503 or [www.state.nh.us](http://www.state.nh.us)

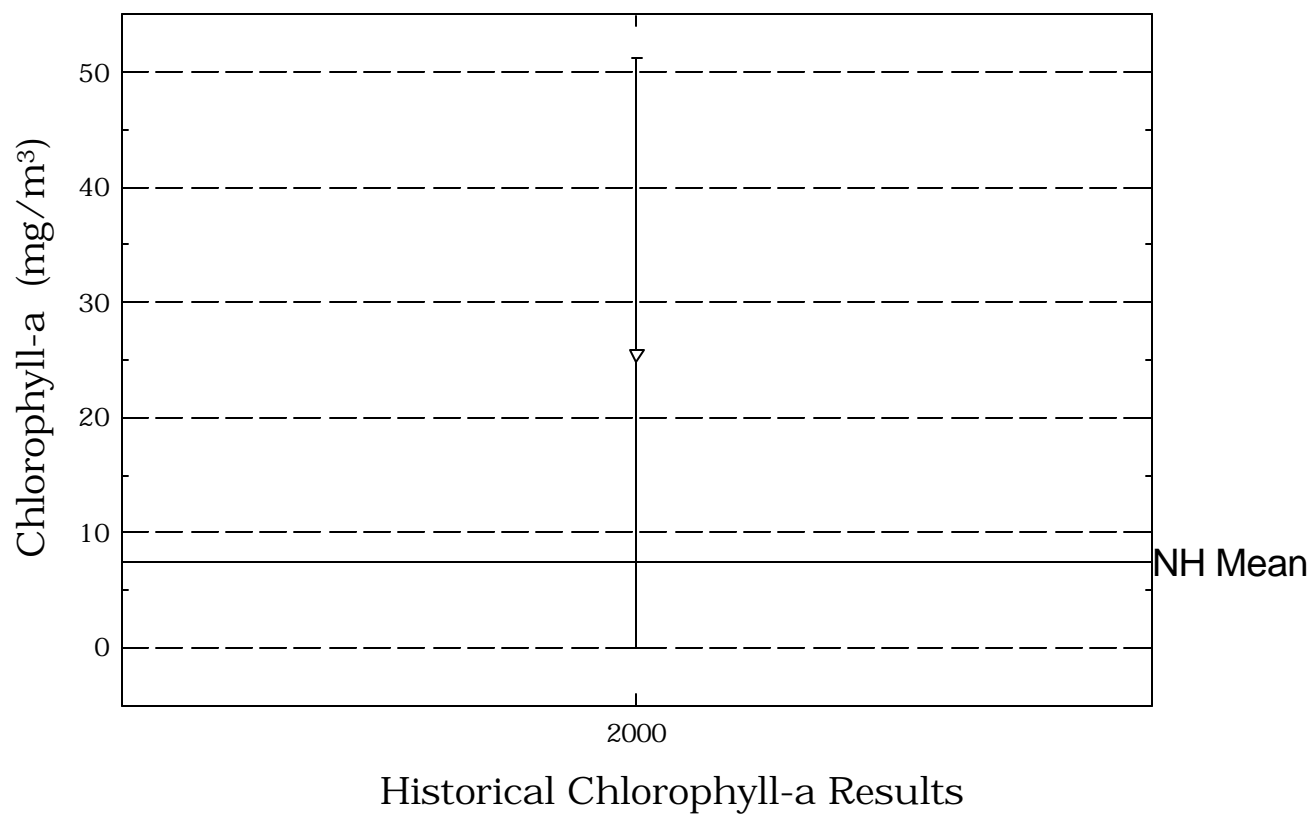
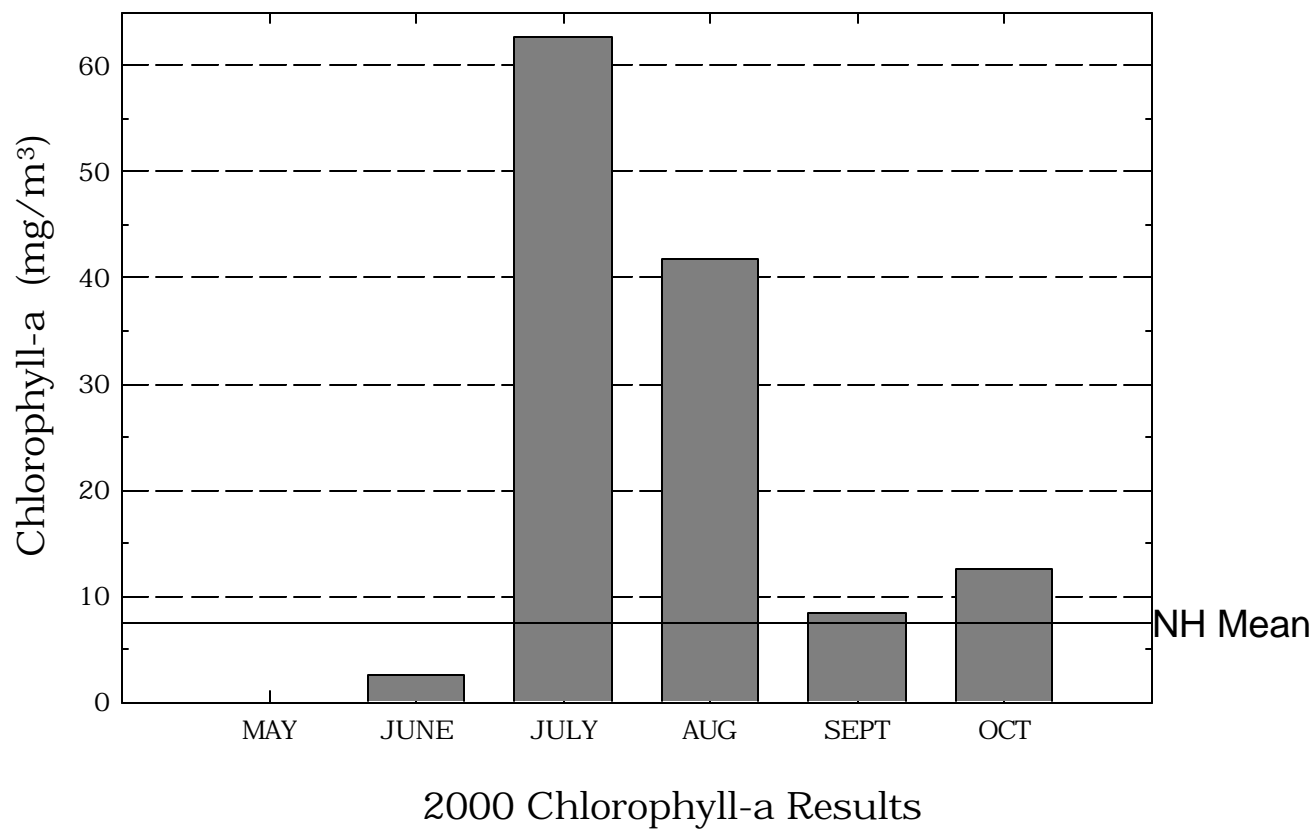
*Lake Eutrophication*, WD-BB-3, NHDES Fact Sheet, (603) 271-3503 or [www.state.nh.us](http://www.state.nh.us)

**2000**

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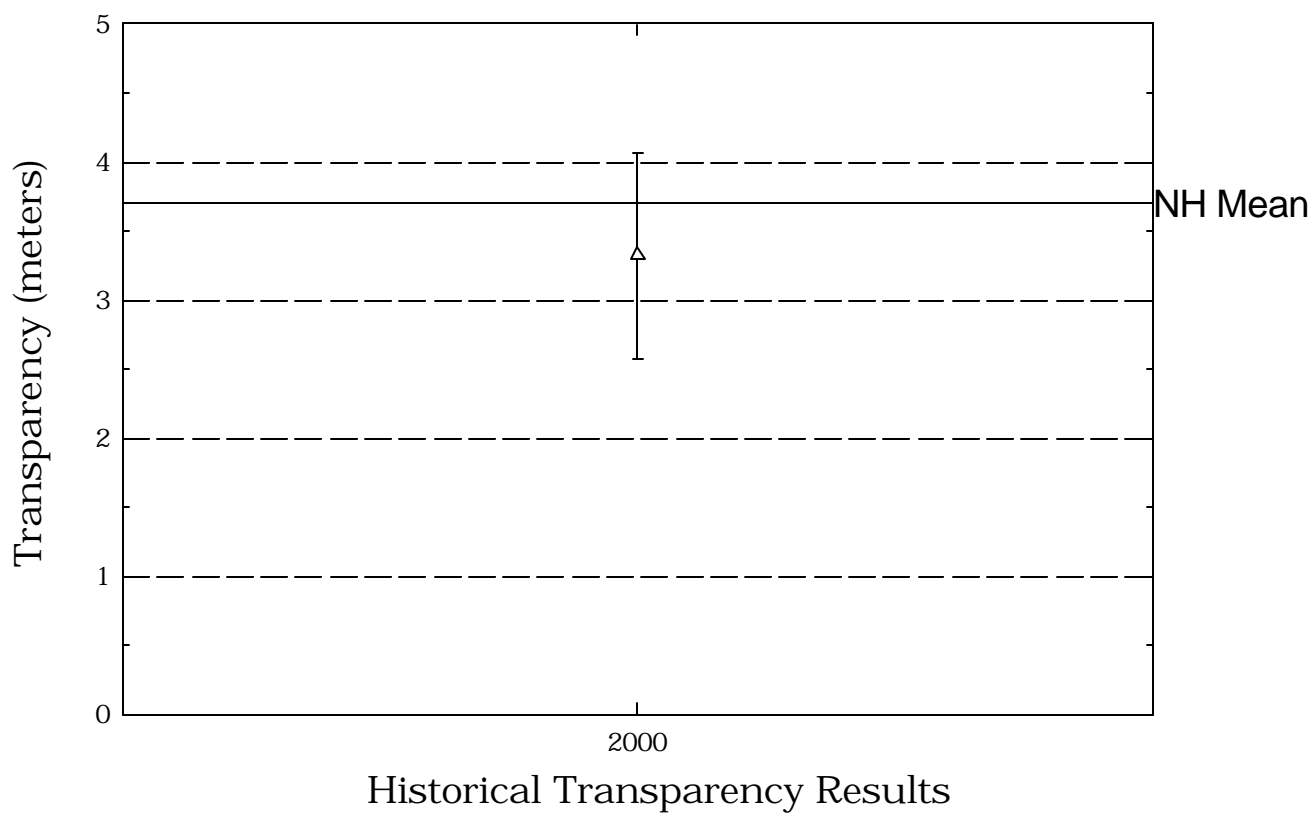
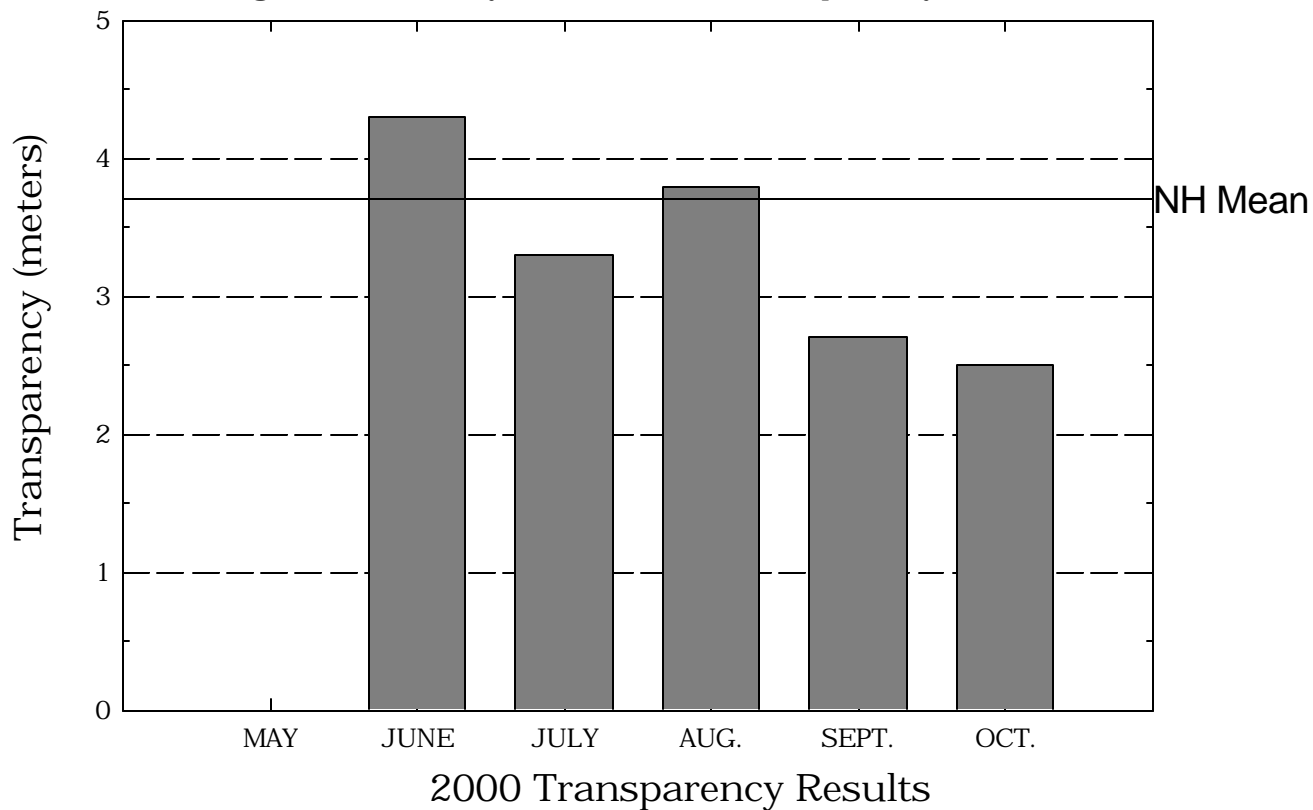
# Nutts Pond

**Figure 1.** Monthly and Historical Chlorophyll-a Results



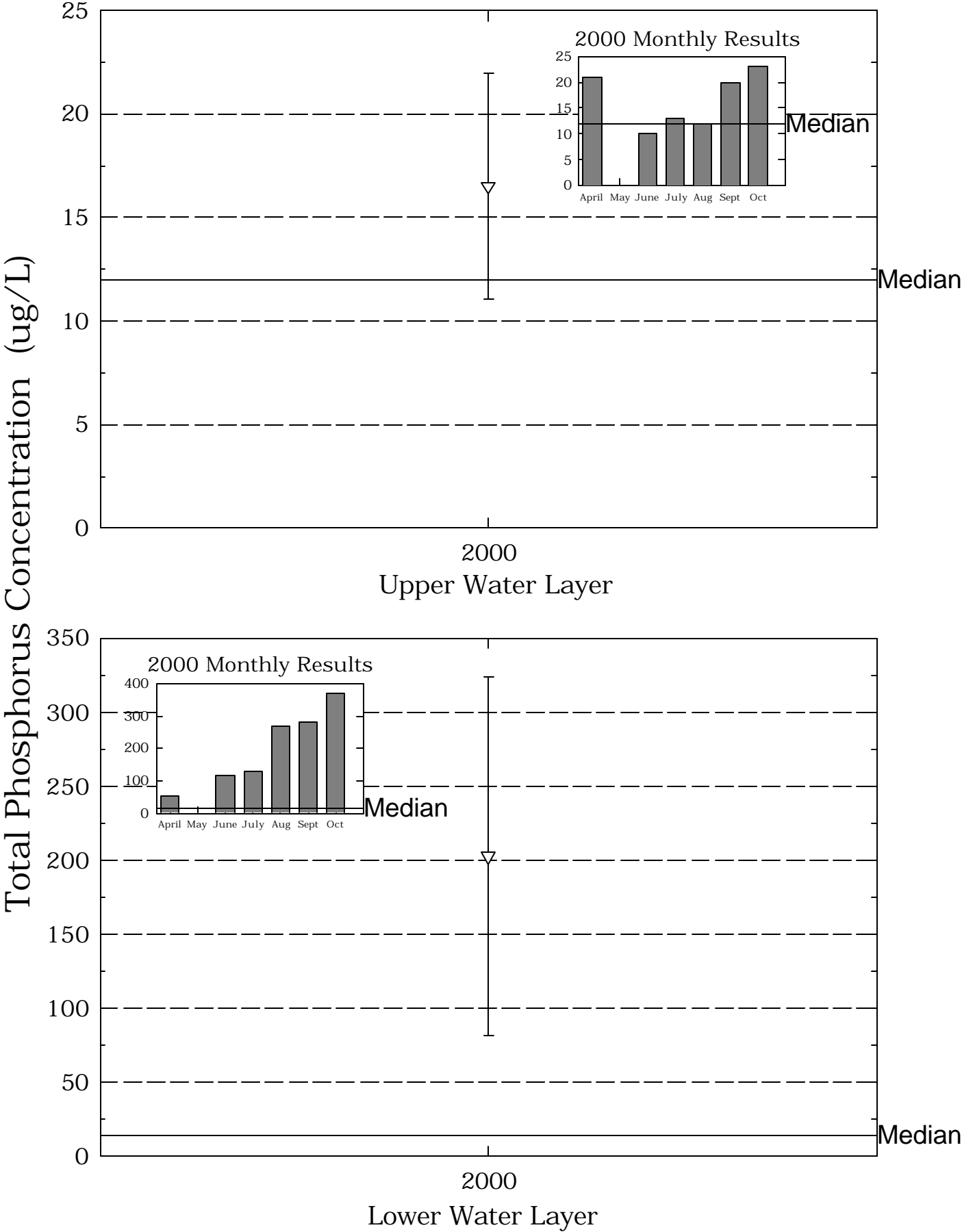
# Nutts Pond

**Figure 2.** Monthly and Historical Transparency Results



# Nutts Pond

**Figure 3.** Monthly and Historical Total Phosphorus Data.



**Table 1.**

**NUTTS POND  
MANCHESTER**

**Chlorophyll-a results (mg/m<sup>3</sup>) for current year and historical  
sampling periods.**

| <b>Year</b> | <b>Minimum</b> | <b>Maximum</b> | <b>Mean</b> |
|-------------|----------------|----------------|-------------|
| 2000        | 2.54           | 62.76          | 24.83       |

**Table 2.****NUTTS POND  
MANCHESTER****Phytoplankton species and relative percent abundance.****Summary for current and historical sampling seasons.**

| <b>Date of Sample</b> | <b>Species Observed</b> | <b>Relative %<br/>Abundance</b> |
|-----------------------|-------------------------|---------------------------------|
| 04/20/2000            | ASTERIONELLA            | 90                              |
|                       | DINOBRYON               | 7                               |
|                       | TABELLARIA              | 3                               |
| 06/28/2000            | CERATIUM                | 100                             |
| 07/24/2000            | CERATIUM                | 66                              |
|                       | DINOBRYON               | 33                              |
|                       | MALLOMONAS              | 1                               |
| 08/30/2000            | CERATIUM                | 96                              |
|                       | DINOBRYON               | 2                               |
|                       | MALLOMONAS              | 2                               |
| 09/22/2000            | ASTERIONELLA            | 95                              |
|                       | OSCILLATORIA            | 4                               |
|                       | MALLOMONAS              | 1                               |
| 10/27/2000            | ASTERIONELLA            | 97                              |
|                       | MALLOMONAS              | 1                               |
|                       | STAURASTRUM             | 1                               |

**Table 3.**

**NUTTS POND  
MANCHESTER**

**Summary of current and historical Secchi Disk  
transparency results (in meters).**

| <b>Year</b> | <b>Minimum</b> | <b>Maximum</b> | <b>Mean</b> |
|-------------|----------------|----------------|-------------|
| 2000        | 2.0            | 4.3            | 3.1         |

**Table 4.****NUTTS POND  
MANCHESTER**

**pH summary for current and historical sampling seasons.  
Values in units, listed by station and year.**

| <b>Station</b>      | <b>Year</b> | <b>Minimum</b> | <b>Maximum</b> | <b>Mean</b> |
|---------------------|-------------|----------------|----------------|-------------|
| EPILIMNION          |             |                |                |             |
|                     | 2000        | 6.79           | 7.14           | 6.97        |
| HYPOLIMNION         |             |                |                |             |
|                     | 2000        | 6.30           | 6.52           | 6.44        |
| INLET AT HOME DEPOT |             |                |                |             |
|                     | 2000        | 6.18           | 6.18           | 6.18        |
| INLET               |             |                |                |             |
|                     | 2000        | 6.94           | 6.94           | 6.94        |
| METALIMNION         |             |                |                |             |
|                     | 2000        | 6.60           | 6.89           | 6.73        |
| OUTLET              |             |                |                |             |
|                     | 2000        | 6.66           | 7.12           | 6.88        |

**Table 5.**

**NUTTS POND  
MANCHESTER**

**Summary of current and historical Acid Neutralizing Capacity.  
Values expressed in mg/L as CaCO<sub>3</sub>.**

**Epilimnetic Values**

| <b>Year</b> | <b>Minimum</b> | <b>Maximum</b> | <b>Mean</b> |
|-------------|----------------|----------------|-------------|
| 2000        | 13.20          | 16.20          | 14.28       |

**Table 6.****NUTTS POND  
MANCHESTER****Specific conductance results from current and historic  
sampling seasons. Results in uMhos/cm.**

| <b>Station</b>      | <b>Year</b> | <b>Minimum</b> | <b>Maximum</b> | <b>Mean</b> |
|---------------------|-------------|----------------|----------------|-------------|
| EPILIMNION          |             |                |                |             |
|                     | 2000        | 392.0          | 695.0          | 484.6       |
| HYPOLIMNION         |             |                |                |             |
|                     | 2000        | 1559.0         | 1940.0         | 1769.0      |
| INLET AT HOME DEPOT |             |                |                |             |
|                     | 2000        | 24.6           | 24.6           | 24.6        |
| INLET               |             |                |                |             |
|                     | 2000        | 826.0          | 826.0          | 826.0       |
| METALIMNION         |             |                |                |             |
|                     | 2000        | 532.0          | 705.0          | 640.2       |
| OUTLET              |             |                |                |             |
|                     | 2000        | 390.0          | 696.0          | 509.2       |

**Table 8.****NUTTS POND  
MANCHESTER****Summary historical and current sampling season Total  
Phosphorus data. Results in ug/L.**

| <b>Station</b>      | <b>Year</b> | <b>Minimum</b> | <b>Maximum</b> | <b>Mean</b> |
|---------------------|-------------|----------------|----------------|-------------|
| EPILIMNION          |             |                |                |             |
|                     | 2000        | 10             | 23             | 16          |
| HYPOLIMNION         |             |                |                |             |
|                     | 2000        | 52             | 368            | 202         |
| INLET AT HOME DEPOT |             |                |                |             |
|                     | 2000        | 184            | 184            | 184         |
| INLET               |             |                |                |             |
|                     | 2000        | 26             | 26             | 26          |
| METALIMNION         |             |                |                |             |
|                     | 2000        | 17             | 50             | 34          |
| OUTLET              |             |                |                |             |
|                     | 2000        | 13             | 30             | 21          |

**Table 9.**  
**NUTTS POND**  
**MANCHESTER**

**Current year dissolved oxygen and temperature data.**

| <b>Depth</b><br>(meters) | <b>Temperature</b><br>(celsius) | <b>Dissolved Oxygen</b><br>(mg/L) | <b>Saturation</b><br>(%) |
|--------------------------|---------------------------------|-----------------------------------|--------------------------|
| <b>April 20, 2000</b>    |                                 |                                   |                          |
| 0.1                      | 10.7                            | 13.1                              | 118.0                    |
| 1.0                      | 10.6                            | 17.2                              | 154.2                    |
| 2.0                      | 10.5                            | 11.0                              | 99.7                     |
| 3.0                      | 10.4                            | 10.2                              | 91.4                     |
| 4.0                      | 10.0                            | 9.4                               | 83.0                     |
| 5.0                      | 8.0                             | 8.3                               | 69.8                     |
| 6.0                      | 5.4                             | 2.8                               | 22.5                     |
| 7.0                      | 5.0                             | 2.0                               | 15.8                     |
| 8.0                      | 5.2                             | 1.6                               | 12.5                     |
| 9.0                      | 5.5                             | 1.0                               | 7.8                      |
| <b>July 24, 2000</b>     |                                 |                                   |                          |
| 0.1                      | 25.5                            | 7.8                               | 94.0                     |
| 1.0                      | 24.4                            | 7.8                               | 93.0                     |
| 2.0                      | 23.4                            | 7.7                               | 91.0                     |
| 3.0                      | 21.8                            | 9.2                               | 105.0                    |
| 4.0                      | 17.4                            | 5.6                               | 59.0                     |
| 5.0                      | 12.1                            | 0.5                               | 4.7                      |
| 6.0                      | 9.4                             | 0.3                               | 2.3                      |
| 7.0                      | 7.4                             | 0.2                               | 1.7                      |
| 8.0                      | 6.7                             | 0.2                               | 1.5                      |
| 9.0                      | 6.5                             | 0.2                               | 1.4                      |
| <b>August 30, 2000</b>   |                                 |                                   |                          |
| 0.1                      | 23.7                            | 7.6                               | 90.0                     |
| 1.0                      | 23.3                            | 7.1                               | 83.0                     |
| 2.0                      | 23.0                            | 7.2                               | 84.0                     |
| 3.0                      | 22.7                            | 7.1                               | 82.0                     |
| 4.0                      | 20.4                            | 8.7                               | 97.0                     |
| 5.0                      | 14.3                            | 2.0                               | 20.0                     |

**Table 9.**  
**NUTTS POND**  
**MANCHESTER**

**Current year dissolved oxygen and temperature data.**

| <b>Depth</b><br>(meters)  | <b>Temperature</b><br>(celsius) | <b>Dissolved Oxygen</b><br>(mg/L) | <b>Saturation</b><br>(%) |
|---------------------------|---------------------------------|-----------------------------------|--------------------------|
| <b>August 30, 2000</b>    |                                 |                                   |                          |
| 6.0                       | 10.0                            | 0.3                               | 3.0                      |
| 7.0                       | 8.1                             | 0.2                               | 1.0                      |
| 8.0                       | 6.9                             | 0.2                               | 1.0                      |
| 8.5                       | 6.8                             | 0.2                               | 1.0                      |
| <b>September 22, 2000</b> |                                 |                                   |                          |
| 0.1                       | 20.1                            | 6.1                               | 67.0                     |
| 1.0                       | 20.1                            | 5.8                               | 63.0                     |
| 2.0                       | 20.1                            | 5.7                               | 64.0                     |
| 3.0                       | 20.0                            | 5.8                               | 63.0                     |
| 4.0                       | 19.7                            | 4.5                               | 49.0                     |
| 5.0                       | 17.5                            | 0.3                               | 3.0                      |
| 6.0                       | 11.5                            | 0.1                               | 1.0                      |
| 7.0                       | 8.7                             | 0.1                               | 1.0                      |
| 8.0                       | 7.5                             | 0.1                               | 1.0                      |
| 9.0                       | 7.2                             | 0.1                               | 1.0                      |
| <b>October 27, 2000</b>   |                                 |                                   |                          |
| 0.1                       | 12.9                            | 7.1                               | 67.0                     |
| 1.0                       | 12.8                            | 6.8                               | 65.0                     |
| 2.0                       | 12.3                            | 6.4                               | 60.0                     |
| 3.0                       | 12.0                            | 5.7                               | 53.0                     |
| 4.0                       | 11.8                            | 5.4                               | 50.0                     |
| 5.0                       | 11.7                            | 4.9                               | 45.0                     |
| 6.0                       | 11.6                            | 4.0                               | 37.0                     |
| 7.0                       | 9.4                             | 0.2                               | 2.0                      |
| 8.0                       | 7.8                             | 0.2                               | 1.0                      |
| 9.0                       | 7.3                             | 0.1                               | 1.0                      |

**Table 10.****NUTTS POND  
MANCHESTER****Historic Hypolimnetic dissolved oxygen and temperature data.**

| <b>Date</b>        | <b>Depth</b><br>(meters) | <b>Temperature</b><br>(celsius) | <b>Dissolved Oxygen</b><br>(mg/L) | <b>Saturation</b><br>(%) |
|--------------------|--------------------------|---------------------------------|-----------------------------------|--------------------------|
| April 20, 2000     | 9.0                      | 5.5                             | 1.0                               | 7.8                      |
| July 24, 2000      | 9.0                      | 6.5                             | 0.2                               | 1.4                      |
| August 30, 2000    | 8.5                      | 6.8                             | 0.2                               | 1.0                      |
| September 22, 2000 | 9.0                      | 7.2                             | 0.1                               | 1.0                      |
| October 27, 2000   | 9.0                      | 7.3                             | 0.1                               | 1.0                      |

**Table 11.****NUTTS POND  
MANCHESTER****Summary of current year and historic turbidity sampling.  
Results in NTU's.**

| <b>Station</b>      | <b>Year</b> | <b>Minimum</b> | <b>Maximum</b> | <b>Mean</b> |
|---------------------|-------------|----------------|----------------|-------------|
| EPILIMNION          |             |                |                |             |
|                     | 2000        | 0.4            | 1.5            | 0.9         |
| HYPOLIMNION         |             |                |                |             |
|                     | 2000        | 10.3           | 64.0           | 41.3        |
| INLET AT HOME DEPOT |             |                |                |             |
|                     | 2000        | 11.5           | 11.5           | 11.5        |
| INLET               |             |                |                |             |
|                     | 2000        | 0.2            | 0.2            | 0.2         |
| METALIMNION         |             |                |                |             |
|                     | 2000        | 0.8            | 2.9            | 1.9         |
| OUTLET              |             |                |                |             |
|                     | 2000        | 0.5            | 1.6            | 1.1         |